

# LAND DISPOSAL RESTRICTIONS

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## OVERVIEW

A common hazardous waste management practice is to place hazardous waste in land-based units (i.e., land treatment units, landfills, surface impoundments, or waste piles). In 2009, approximately 56 percent of hazardous wastes generated under RCRA were permanently disposed by deepwell/underground injection, landfill and land treatment/application/farming . The permanent disposal of hazardous waste in land-based units has the potential to threaten human health and the environment through ground water contamination. As a result, the RCRA program contains extensive technical requirements to ensure that land-based units prevent hazardous leachate from escaping into the environment. To complement the unit-specific standards, which alone do not fully protect human health and the environment from the potential risks of land-based hazardous waste management, RCRA includes the land disposal restrictions (LDR) program.

The LDR program approaches ground water protection differently from unit-specific technical

standards. This program does not mandate physical barriers to protect ground water, but instead requires that hazardous wastes undergo fundamental physical or chemical changes so that they pose less of a threat to ground water, surface water, and air when disposed. The obvious advantage of such hazardous waste treatment is that it provides a longer lasting form of protection than does simple hazardous waste containment. While synthetic barriers designed to prevent the migration of leachate can break down and fail over time, physical and chemical changes to the waste itself provide a more permanent type of protection.

When directing EPA to establish the LDR program, Congress called for regulations that specified concentrations of hazardous constituents or methods of treatment that would substantially decrease the toxicity of hazardous waste or decrease the likelihood that contaminants in such wastes would leach. EPA responded to these requirements by establishing waste-specific treatment standards that dictate to what extent waste must be treated. All hazardous wastes, except under certain circumstances, must meet a specific treatment standard before they can be disposed.

## APPLICABILITY

Wastes must be a RCRA hazardous waste in order to be subject to the LDR program. In other words, unless a waste meets the definition of a solid and hazardous waste, its disposal is not regulated under the LDR program. Once a generator identifies its waste as hazardous (either listed, characteristic,

or both), the waste is assigned a waste code. When EPA establishes a treatment standard for the waste code, the waste will then become restricted (i.e., subject to the LDR requirements). RCRA requires that EPA establish treatment standards for hazardous wastes within six months of promulgating a new listing or characteristic. Until EPA establishes a treatment standard for a waste, this newly identified or newly listed waste (i.e., waste for which EPA has yet to establish a treatment standard) can continue to be land disposed without treatment. When EPA promulgates a final treatment standard for a waste, handlers of the waste must manage it in accordance with all the LDR requirements and cannot dispose of it on the land until it meets all applicable treatment standards.

While the LDR program generally applies to all persons who generate, transport, treat, store, or dispose of restricted hazardous wastes, there are exclusions from the LDR requirements. The following wastes are not subject to the LDR program:

- Waste generated by conditionally exempt small quantity generators (CESQGs)
- Waste pesticides and container residues disposed of by farmers on their own land
- Newly identified or newly listed hazardous wastes for which EPA has yet to promulgate treatment standards
- Certain waste releases that are mixed with a facility's wastewater and discharged pursuant to the Clean Water Act (CWA).

Wastes meeting any of these descriptions may continue to be land disposed without being subject to the LDR program.

The LDR requirements attach to a hazardous waste at its point of generation. In other words, once a waste has been generated, identified, and assigned a waste code, it must be treated in accordance with LDR requirements before being disposed. As a general principle, a hazardous waste must meet all applicable treatment standards to be eligible for land disposal. For purposes of the LDR program, a generator of a listed hazardous waste must determine

if the waste also exhibits any hazardous waste characteristics. If it does, then the waste must be treated to meet both the listed and characteristic treatment standards before land disposal.

## LDR PROHIBITIONS

The LDR program consists of three main components: the disposal prohibition, the dilution prohibition, and the storage prohibition. This series of prohibitions restricts how wastes subject to LDR requirements are handled. The most visible aspect of the LDR program is the disposal prohibition, which includes treatment standards, variances, alternative treatment standards, and notification requirements. **Land disposal** means placement in or on the land, except in a corrective action unit, and includes, but is not limited to, placement in a landfill, surface impoundment, waste pile, injection well, land treatment facility, salt dome formation, salt bed formation, underground mine or cave, or placement in a concrete vault, or bunker intended for disposal purposes. The dilution and storage prohibitions work in tandem with the disposal prohibition to guide the regulated community in proper hazardous waste management. The dilution prohibition ensures that wastes are properly treated, and the storage prohibition ensures that waste will not be stored indefinitely to avoid treatment.

### ■ Disposal Prohibition

The first component of the LDR program, the **disposal prohibition**, prohibits the land disposal of hazardous waste that has not been adequately treated to reduce the threat posed to human health and the environment. The criteria that hazardous wastes must meet before being disposed of are known as **treatment standards**. These treatment standards can be either concentration levels for hazardous constituents that the waste must meet or treatment technologies that must be performed on the waste before it can be disposed.

EPA bases the LDR treatment standards on the performance of available technologies. EPA conducts extensive research into available treatment technologies to determine which proven, available technology is the best at treating the waste in

question. The technology that best minimizes the mobility or toxicity (or both) of the hazardous constituents is designated as the **Best Demonstrated Available Technology (BDAT)** for that waste. The treatment standards are based on the performance of this BDAT.

When treatment standards are set as concentration levels, the regulated community may use any method or technology (except dilution, as discussed later in this chapter) to meet that concentration level. The concentration level is based on the performance of the BDAT, but the regulated community does not need to use this technology to meet the treatment standard. EPA prefers to use concentration-based standards because they stimulate innovation and the development of alternative treatment technologies. However, when EPA feels that the waste will only be effectively treated by the BDAT or when there is no way to measure hazardous constituent levels, the Agency will designate a technology as the treatment standard. This means that the regulated community must treat the waste with that specific technology in order to meet the treatment standard.

The treatment standards are found in the regulations in a table arranged by hazardous waste code (40 CFR §268.40). Concentration-based treatment standards appear in the table as numeric values. The treatment standards that require the use of a specific technology are expressed as a five-letter code representing the technology. There are 31 such codes representing specific technology-based standards. Descriptions of these codes and the technologies that they require are found in the regulations in a separate table in 40 CFR §268.42 (see Figure III-12).

### Characteristic Hazardous Wastes

Both listed and characteristic hazardous wastes must meet the LDR treatment standards before they are eligible for land disposal. There are, however, some unique situations that arise when dealing with characteristic wastes (those with the letter “D” waste code designation) under the LDR program.

The treatment standards for most characteristic hazardous wastes entail rendering the waste nonhazardous (i.e., decharacterizing the waste

or removing the characteristic). However, some characteristic waste treatment standards have additional requirements. The regulated community must examine these

wastes for **underlying hazardous constituents**.

These constituents are not what causes the waste to exhibit a characteristic, but they can pose hazards nonetheless. The underlying hazardous constituents must be treated in order to meet contaminant-specific levels. These levels are referred to as the **universal treatment standards (UTS)**, and are listed in a table in the RCRA regulations (40 CFR §268.48). This is why some characteristic wastes that no longer exhibit a characteristic must still be treated to meet additional LDR requirements. Once such characteristic hazardous wastes have been decharacterized and treated for underlying constituents, they can be disposed of in a nonhazardous waste landfill.

### DISPOSAL PROHIBITION

The disposal prohibition prohibits the land disposal of hazardous waste that has not been adequately treated to reduce the threat posed by such waste.

### Variances, Extensions, and Exemptions

If a restricted waste does not meet its applicable treatment standard, it is prohibited from land disposal. Although most wastes become eligible for disposal by meeting the treatment standards, in some instances this may not be possible. For example, there may not be enough treatment capacity to treat a waste, or the concentration level may not be achievable. To address these situations, EPA established procedures that allow wastes to be disposed of under special circumstances. The following exemptions, variances, and extensions allow wastes to be disposed of without meeting their respective treatment standards, or to be treated to a different standard:

- National capacity variances
- Case-by-case extensions
- No-migration variances
- Variances from a treatment standard
- Equivalent treatment method variances
- Surface impoundment treatment exemptions.

**Figure III-12: Summary of Selected Technologies from the 40 CFR §268.42 Technology-Based Standards Table**

Code	Technology	Description
BIODG	Biodegradation	Biodegradation uses microorganisms to break down organic compounds to make a waste less toxic.
CHRED	Chemical reduction	Chemical reduction converts metal and inorganic constituents in wastewater into insoluble precipitates that are later settled out of the wastewater, leaving a lower concentration of metals and inorganics in the wastewater.
CMBST	Combustion	Combustion destroys organic wastes or makes them less hazardous through burning in boilers, industrial furnaces, or incinerators.
DEACT	Deactivation	Deactivation is treatment of a waste to remove the characteristic of ignitability, corrosivity, or reactivity. Deactivation can be achieved using many of the treatment technologies in 40 CFR §268.42, Table 1. Part 268, Appendix VI recommends technologies that can be used to deactivate specific wastestreams.
MACRO	Macroencapsulation	Macroencapsulation is the application of a surface coating material to seal hazardous constituents in place and prevent them from leaching or escaping.
NEUTR	Neutralization	Neutralization makes certain wastes less acidic or certain substances less alkaline.
PRECP	Precipitation	Precipitation removes metal and inorganic solids from liquid wastes to allow for safe disposal.
REMTL	Recovery of Metals	Recovery of organics uses direct physical removal methods to extract metal or inorganic constituents from a waste.
RORGS	Recovery of Organics	Recovery of organics uses direct physical removal methods (e.g., distillation, steam stripping) to extract organic constituents from a waste.
STABL	Stabilization	Stabilization (also referred to as solidification) involves the addition of stabilizing agents (e.g., Portland cement) to a waste to reduce the leachability of metal constituents.

While national capacity variances, when needed, are automatically granted to all affected hazardous waste management facilities, the other five exemptions, variances, and extensions require a facility to specifically petition the Agency.

#### *National Capacity Variances*

When developing a treatment standard, EPA examines the available treatment capacity to determine whether it is sufficient to handle current and future waste management needs. If the Agency determines that nationally there is not enough capacity to treat a waste, EPA can automatically extend the effective date of the waste's treatment standard. Such an extension to the effective date is intended to give the waste treatment industry more time to develop the capacity to handle the

waste. Wastes under a national capacity variance can be disposed of, without meeting the treatment standards, in landfills and surface impoundments that meet minimum technical requirements (e.g., liners, leachate collection and removal systems, and leak detection systems). (These technical requirements are fully discussed in Chapter III, Regulations Governing Treatment, Storage, and Disposal Facilities).

#### *Case-by-Case Extensions*

A facility may petition EPA for a case-by-case extension to delay the effective date of a waste's treatment standard, upon showing that capacity does not exist for that particular waste. Similar to national capacity variances, wastes granted case-by-case extensions can be disposed of without

### CASE STUDY: DECHARACTERIZED WASTES AND THE REQUIREMENT TO TREAT FOR UNDERLYING HAZARDOUS CONSTITUENTS

A facility generates an industrial nonwastewater that contains benzene, acetone, and methanol. The generator determines that their waste is not listed based on its origin, but upon testing the waste, determines that it fails the TCLP for benzene. As a result, the waste is identified as D018. According to the LDR treatment standard for D018, the benzene in the waste must be treated to a standard of 10 mg/kg, and the waste must also be treated for acetone and methanol underlying hazardous constituents. The generator decides to treat the waste in containers at the facility. After treatment, the benzene meets the 10 mg/kg standard and no longer exhibits a characteristic. Although the waste is technically no longer a hazardous waste, it must be treated for the acetone and methanol underlying hazardous constituents before it can be land disposed.

meeting the treatment standards in landfills and surface impoundments that meet minimum technical requirements. However, these extensions are no longer available for most wastes because they may only be granted within four years of the promulgation of the LDR treatment standard.

#### *No-Migration Variances*

No-migration variances differ from capacity variances in that they apply to the disposal unit instead of to the waste, and allow wastes to be disposed of in the unit without meeting the treatment standards. To obtain a no-migration variance for a disposal unit, a facility must petition EPA and demonstrate that there will be no migration of hazardous constituents from the unit (i.e., the waste will not leak or escape from the unit) for as long as the wastes remain hazardous.

#### *Variances from a Treatment Standard*

Variances from a treatment standard allow the regulated community to petition EPA and show that the required LDR treatment standard is not appropriate for their waste, or that the treatment standard is not achievable. If a variance is granted, EPA will specify an alternative standard to meet.

#### *Determinations of Equivalent Treatment*

Determinations of equivalent treatment allow the regulated community to petition EPA and demonstrate that a technology different from the required LDR treatment technology can achieve the same results. If approved, the applicant can use the alternative technology in place of the required technology.

#### *Surface Impoundment Treatment Exemptions*

Surface impoundment treatment exemptions allow the regulated community to petition EPA for permission to treat hazardous waste in surface impoundments (surface impoundments are fully discussed in Chapter III, Regulations Governing Treatment, Storage, and Disposal Facilities). Under normal circumstances, owners and operators cannot place untreated hazardous waste on the land, even if it is in a land-based unit for treatment. Since many facilities use surface impoundments as a means of treating waste, the surface impoundment treatment exemption allows owners and operators to conduct such treatment under certain conditions. Surface impoundments treating waste under this exemption must comply with double liner and minimum technical requirements, and provisions for the removal of sludges and treatment residues.

#### **Alternative Treatment Standards**

In establishing treatment standards, the Agency applied the BDAT methodology to the typical forms of waste generated by industry. Some forms of hazardous waste are unique and were not taken into account by the BDAT process when treatment standards were established. As a result, EPA created a number of broad, alternative treatment standards for special types of waste.

#### *Lab Packs*

Laboratories commonly generate small volumes of many different listed hazardous wastes. Rather than manage all these wastes separately, labs often consolidate these small containers into **lab packs**. Trying to meet the individual treatment standards for every waste contained in a lab pack would be impractical. To ease the compliance burden, EPA

established an alternative treatment standard for lab packs that allows the whole lab pack to be incinerated, followed by treatment for any metal in the residues (§268.42(c)). Treatment using this alternative standard satisfies the LDR requirements for all individual wastes in the lab pack. However, there are limits on the types of wastes that may be included in lab packs.

### *Debris*

**Debris** can become contaminated with hazardous waste accidental releases or spills. While such contaminated debris is typically regulated under the contained-in policy (as discussed in Chapter III, Hazardous Waste Identification), it may also be subject to LDR treatment standards. The physical characteristics of such debris may make it difficult to meet the LDR treatment standard for the waste that is contaminating it. For example, incinerating a solvent-saturated brick wall might not be possible without damaging the rotating combustion chamber in an incinerator. Instead of requiring debris to meet these sometimes inappropriate and difficult standards, EPA established a set of alternative standards that can be used to treat hazardous debris (40 CFR §268.45, Table 1). The alternative standards range from removing all contaminants with high pressure washing, to encapsulating the debris in order to prevent hazardous constituents from leaching. Debris treated with these alternative treatment standards meets the LDR requirements, and in many cases, can be disposed of as nonhazardous waste.

### *Soil*

Cleanup, or remediation, of hazardous waste sites will often produce contaminated soil. Contaminated soil must be handled as hazardous waste if it contains a listed hazardous waste or if it exhibits a characteristic of hazardous waste (see discussion of the contained-in policy in Chapter III, Hazardous Waste Identification). As with hazardous waste, land disposal of hazardous soil is prohibited until the soil has been treated to meet LDR standards. These contaminated soils, due to either their large volume or unique properties, are not always amenable to the waste code-specific treatment standards found in §268.40. Because of

this, EPA promulgated alternative soil treatment standards in §268.49.

The alternative soil treatment standards mandate reduction of hazardous constituents in the soil by 90 percent or ten times UTS, whichever is higher. Removal of the characteristic is also required if the soil is ignitable, corrosive, or reactive.

### **Notification, Certification, and Recordkeeping**

In order to properly track the hazardous waste that is generated, transported, treated, stored, and disposed of, EPA imposes certain LDR notification, certification, and recordkeeping requirements on generators and treatment, storage, and disposal facilities (TSDFs). LDR notifications inform the next waste handler how the waste must be treated to meet the treatment standard or if it can be disposed of without treatment. When wastes do not need to meet a treatment standard, or already meet the standard, EPA requires the handler to sign a statement certifying such a claim.

Generators must send a notification with the initial shipment of every waste and keep a copy in their on-site files. If the waste, process, or receiving facility changes, another notification is required. The information that the notification must include varies according to the status of the waste. For example, the notification requirements will differ slightly if the waste meets its treatment standard or is subject to a national capacity variance.

Treatment facilities have to send similar notifications along with the shipment of treated wastes to disposal facilities and keep a copy in their on-site files. A certification normally accompanies this notification stating that the waste meets its treatment standards and may be land disposed. Disposal facilities are the final link in the waste management chain. As a result, they have to test the waste residue that they receive to ensure that it meets the treatment standards.

Each hazardous waste handler must comply with certain recordkeeping requirements for LDR notifications and paperwork. Generators, treatment facilities, and disposal facilities must keep copies of all LDR paperwork associated with the waste they ship or receive in their facility files for three years.



Characteristic wastes that are decharacterized subsequent to the point of generation (i.e., they become nonhazardous) are handled differently. Once a waste is decharacterized and has met its full LDR treatment standards, it can go to a RCRA Subtitle D nonhazardous waste facility. Copies of these LDR notifications and certifications are sent to the EPA Region or authorized state and placed in the facility's files and sent to the EPA Region or authorized state rather than to the receiving Subtitle D facility. This is intended to protect Subtitle D facilities from the burden of hazardous waste paperwork.

## ■ Dilution Prohibition

The second component of the LDR program is the **dilution prohibition**. When a waste's treatment standard is expressed as a numeric concentration level, it is often easier and less expensive to dilute the waste in water or soil in order to reduce the concentration of the hazardous constituents. This type of activity does not reduce the overall or mass load of toxic chemicals that could be released to the environment, and is inconsistent with the goals of the LDR program. To prevent this activity from being practiced, EPA established the dilution prohibition. The dilution prohibition states that it is impermissible to dilute hazardous waste to circumvent proper treatment. Adding water or soil to a waste to dilute it, combining wastes not amenable to the same type of treatment, and incinerating metal wastes are all examples of impermissible dilution.

### DILUTION PROHIBITION

The dilution prohibition forbids dilution, such as the addition of soil or water to waste, in order to reduce the concentrations of hazardous constituents, and can prohibit treatment of a waste by ineffective or inappropriate treatment methods. Examples of ineffective or inappropriate treatment include biodegradation, combustion, or incineration of metals, and stabilization of organics. The clearest objective indication that proper treatment is being conducted is if the treatment is the same type as that on which the treatment standard is based (i.e., if the treatment method is the same as the BDAT that established the waste's treatment standard) or if the treatment process actually destroys or removes hazardous constituents.

## ■ Storage Prohibition

The final component of the LDR program is the **storage prohibition**. Before a waste can be treated, it is usually stored in units, such as containers and tanks. These storage units are not intended for the long-term management of waste, and therefore, are not required to provide the same level of protective measures as disposal units. To prevent indefinite storage, EPA regulations state that if waste storage exceeds one year, the facility has the burden of proving that such storage is being maintained in order to accumulate quantities necessary for effective treatment or disposal.

For storage less than one year, EPA has the burden of proving that such storage is not for the purpose of accumulating quantities necessary for effective treatment or disposal. Generators accumulating waste on site within their respective accumulation time limits (as discussed in Chapter III, Regulations Governing Hazardous Waste Generators), and transfer facilities temporarily storing manifested shipments of hazardous waste for less than 10 days (as discussed in Chapter III, Regulations Governing Hazardous Waste Transporters), are not subject to this burden of proof requirement.

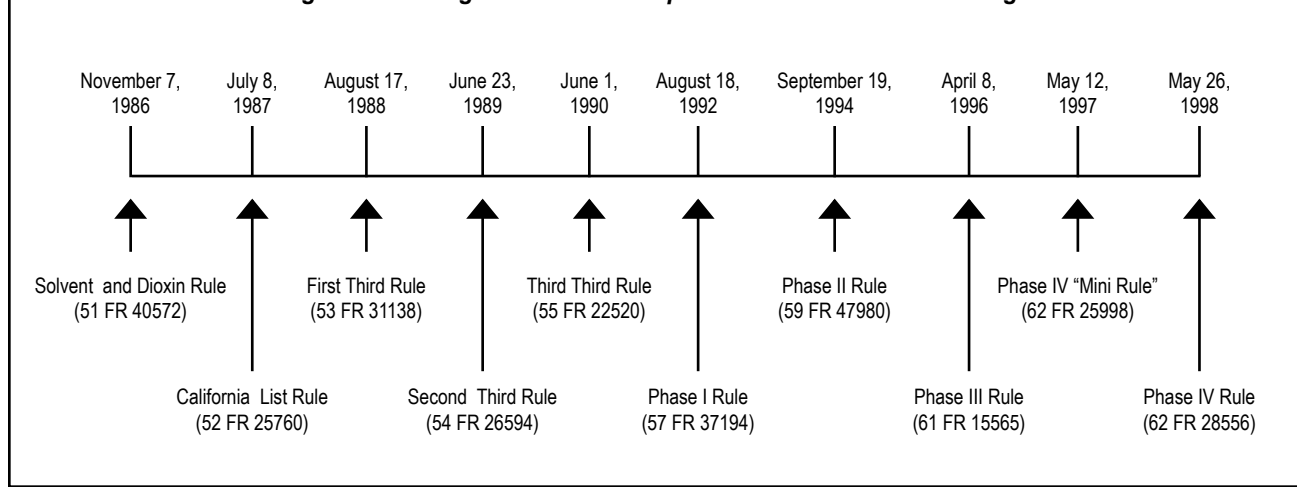
### STORAGE PROHIBITION

The storage prohibition prevents the indefinite storage of untreated hazardous waste for reasons other than the accumulation of quantities necessary for effective treatment or disposal.

## HISTORY OF LDR

The LDR program has a complicated history. The progression of the LDR program is important in understanding how and why the LDR program operates the way it does today (see Figure III-13).

The Hazardous and Solid Waste Amendments (HSWA) established the authority for the LDR program. When HSWA was enacted, EPA had already listed and identified a large number of hazardous wastes. As a result, the Agency had to gradually address these wastes by establishing LDR treatment standards in stages. Congress directed EPA to address certain high-risk and high-volume

**Figure III-13: Significant Land Disposal Restrictions Rulemakings**

wastes first, and established a three-part schedule for EPA to follow in addressing the remaining wastes. The three parts of this schedule are known as the Thirds.

Before EPA could address the wastes in the Thirds, the Agency was required to address those wastes that were high-risk (dioxins) and those wastes that were generated in large amounts (solvents). The treatment standards for these wastes were promulgated on November 7, 1986. This rulemaking also established the basic framework for the LDR program.

Because EPA's promulgation of LDR treatment standards for the large number of wastes in the Thirds would take considerable time, the Agency established interim treatment standards to ensure adequate protection of human health and the environment. These interim standards are known as the **California List**. The list, based on a program established by California's Department of Health Services, became effective on July 8, 1987. These standards did not target specific waste codes, but rather wastes containing certain toxic constituents or exhibiting certain properties. As EPA established waste-specific treatment standards in the Thirds, the California list provisions were superseded. All of the provisions on the list have now been superseded.

To address the wastes that were to be covered under the Thirds, EPA ranked the wastes according to hazard and volume generated. Those wastes that posed the greatest potential threat were addressed

first through a rulemaking on August 17, 1988. These wastes are known as the First Third wastes. The treatment standards for the Second Third wastes were promulgated on June 23, 1989, and the treatment standards for the Third Third wastes were promulgated on June 1, 1990.

While EPA was addressing the solvents, dioxins, and the Thirds, other hazardous wastes were being listed and identified as part of the Agency's continuing process of hazardous waste identification. These newly listed and identified wastes, which became subject to RCRA after HSWA, were grouped in their own respective schedules. These schedules are known as the Phases. These schedules not only promulgated treatment standards for newly listed and identified wastes, but also made minor modifications and improvements to the LDR regulatory program.

On August 18, 1992, EPA promulgated Phase I, which finalized treatment standards for the first set of newly listed wastes and established alternative treatment standards for hazardous debris. On September 19, 1994, EPA promulgated Phase II, which also finalized treatment standards for additional newly listed wastes and added the UTS table (40 CFR §268.48). On April 8, 1996, EPA promulgated Phase III, which not only finalized treatment standards for a third set of newly listed wastes, but also prohibited the combustion of metals (such treatment is ineffective and thus constitutes impermissible dilution). On May 12, 1997, EPA promulgated the first half of Phase IV (called the



Phase IV “Mini-Rule”), which finalized the last set of treatment standards for newly listed wastes and modified the LDR notification requirements. The second half of Phase IV, published on May 26, 1998, completed the schedule established by the Phases by finalizing treatment standards for newly identified toxicity characteristic metal wastes and formerly exempt mineral processing wastes, and established alternative treatment standards for soil contaminated with hazardous waste.

With the completion of the four Phases, EPA has promulgated standards for all currently identified and listed hazardous wastes. EPA now promulgates the LDR treatment standards for a waste when the waste is initially identified or listed.

## **SUMMARY**

The LDR program is designed to protect ground water from contamination by requiring hazardous wastes to be physically or chemically altered to reduce the toxicity or mobility of hazardous constituents prior to disposal. The LDR requirements apply to all hazardous wastes (with a few exceptions) once a treatment standard has been established for the waste. These requirements attach at the point of generation, at which time generators must determine both hazardous waste listings and characteristics. Based on this determination, the waste must meet all applicable treatment standards before disposal. The LDR program consists of prohibitions on:

- Disposal
- Dilution
- Storage.

The disposal prohibition requires that hazardous wastes be treated to meet waste specific treatment standards before disposal. These standards are based on the BDAT process and requires treatment to a specific concentration level or treatment by a specific technology. EPA established a series of variances, exemptions, and extensions to address those situations where the required treatment standard cannot be achieved. The LDR program also includes alternative treatment standards for unique wastestreams, such as lab packs, debris, and soil. To ensure that wastes receive proper treatment and are managed appropriately, EPA also established notification and recordkeeping requirements.

The dilution prohibition prevents treatment by ineffective or inappropriate methods. The storage prohibition is intended to require expeditious treatment.

Since 1986, when the first treatment standards were promulgated, the LDR program has continually evolved. EPA has finished establishing treatment standards for all existing, newly identified, and newly listed wastes based on two rulemaking schedules (the Thirds and Phases), and the Agency now establishes treatment standards for hazardous wastes when they are either listed or identified.

## **ADDITIONAL RESOURCES**

Additional information about the topics covered in this chapter can be found at [www.epa.gov/epawaste/hazard/tsd/ldr](http://www.epa.gov/epawaste/hazard/tsd/ldr).

